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Empirical Research on the Impact of Intellectual Capital as a Determinant of the Growth of Market Value of Companies

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Abstract - *The development of information and communication technologies and the creation of knowledge bases has resulted in a large number of incremental and radical innovations in various spheres. The condition for the survival of companies in the knowledge economy is to meet the increasingly sophisticated needs of consumers. In order for companies to follow this trend, it is necessary to constantly improve (innovate) their products and / or services and create added value for the consumer, which is a source of creating and maintaining a competitive advantage in the market. As innovations "repose" in the knowledge of individuals, companies invest a significant amount of financial resources in the education of their employees because they represent a part of the intellectual capital of the company. The subject of this paper is the analysis of the relationship between investment in R&D and market cap. The aim is to show how investing in research and development affects the market value of companies.*

Keywords – *Intellectual capital, market cap, expenditure R&D*

I INTRODUCTION

The fundamental goal of any economic entity is to build and maintain a competitive advantage. The knowledge economy represents a new stage in world economies in which knowledge and intellectual resources take precedence over traditional resources (physical and financial). As a knowledge economy or "new economy" as it is still defined as a follower of an industrial era dominated by resources such as labor, means of labor, land, and capital, in the modern era of business, the success of companies is based on investment in research and development (R&D) and building the quality infrastructure of intellectual capital (IC). The global economy, development of information and communication networks, technical and technological development in all spheres of life have influenced the creation of increasingly sophisticated demand. The basic postulates of the knowledge economy are based on investment in research and development and continuous innovation in all sectors and business segments, which results in the creation of the enterprise's intangible resources [1]. The key to a company's success is meeting a wide range of increasingly sophisticated consumer demands instead of focusing on mass production as in the industrial era.

The concept of IC, a relatively new construct shaped by the demand of modern customers, is becoming a very interesting segment of scientific re[4]search. On the other hand, the gap between the market and book value of companies capitalized on world-famous stock exchanges is largely

explained by the emergence of intellectual resources within companies that are not reported. Good connections with distribution channels, customer loyalty, well-known brand, good reputation, and image are just some segments of intellectual capital that are partially or entirely excluded from the framework of business and financial reporting. Therefore, efforts are being made to ensure adequate treatment of identification, measurement, balancing, and control of all intellectual resources through legal accounting regulations.

II CONCEPT AND ELEMENTS IC

In the knowledge economy, people represent a strategically important resource of the company based on whose competencies and skills other resources are built and used more efficiently. This further argues that the resources that create value in the era of the "new economy" are increasing "physically intangible and invisible" as well as that they appear in the form of different types of knowledge (combined and interconnected), i.e., in the form of organizational competence [2]. There are various definitions of IC due to the large number of theorists who have researched the existence of intellectual resources in organizations, with most theorists agreeing that IC is "knowledge that can be converted into profit" [3] or "packaged useful knowledge" [4]. Many concepts of IC companies have been differentiated from different definitions and understandings of IC. Some of the better-known concepts are Sullivan's [3], Sveiby's [5], Edvinsson's [6], Steward's [7], and Roos's [8] concept of intellectual capital, which essentially distinguishes three dimensions of the company's intellectual resources: human, structural, and relational capital.
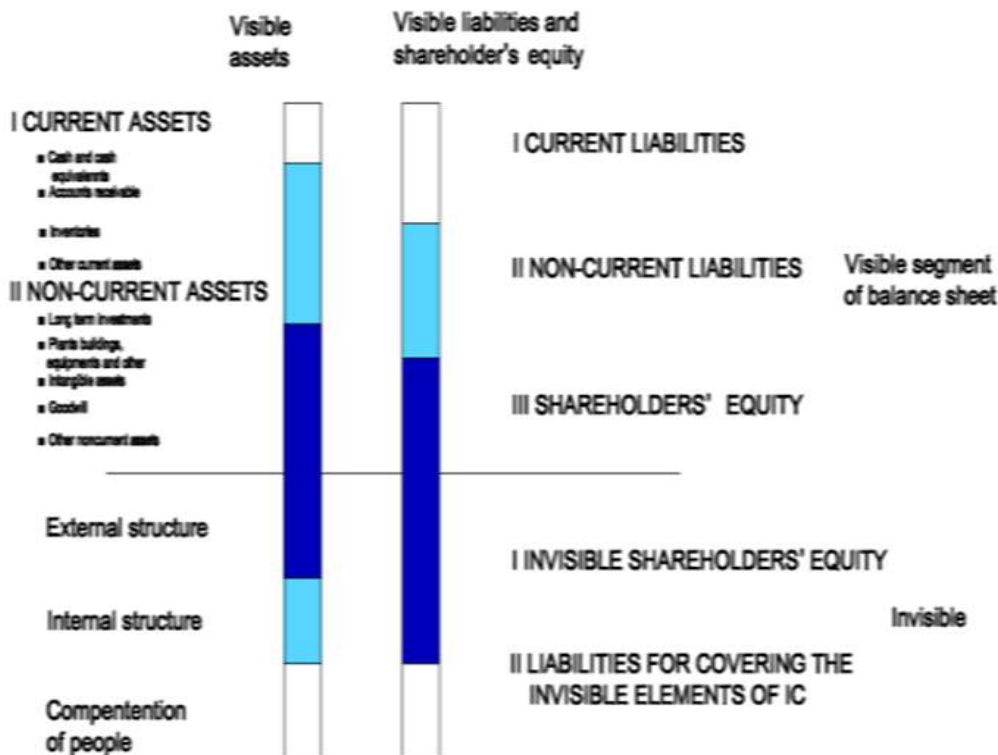
Source: Krstic, B., (2014) adapted to the idea Sveiby K.E., (1997), The New Organizational Wealth-Managing and Measuring Knowledge-Based Assets, Berrett-Koehler Publishers, Inc., p.11

It is considered that the difference between the market and book value of the company arises through the investment in R&D, which creates intellectual capital that is not included in the balance sheet. The result of numerous independent studies by IC theorists (Edvinsson and Malone [6]; Roos et al. [8]; Sveiby [5]; and Stewart [7]) the following formula confirms the above:

$$BV + IC = MV$$

Where:

MV = Market Value

BV = Book Value = (MC + PC)

MC = Monetary Capital

PC = Physical Capital

IC = Intellectual Capital = (HC+IVC+RC+SC)

HC = Human Capital

IVC = Innovation Capital

RC = Relationship Capital/Customer Capital

SC = Structural Capital/Process Capital

Numerous studies testify to the positive impact of IC on the market and financial performance of companies. The Erickson and Rothberg [10] study of IT companies concluded that adequate and efficient knowledge management in the organization has an impact on increasing the market performance of companies.

III EMPIRICAL INVESTIGATION OF THE IMPACT OF IC ON THE MARKET VALUE OF COMPANIES

The fundamental problem of the gap between the market and book value of modern companies from intellectually intensive economic spheres, such as information and communication technologies, software design and development, the pharmaceutical industry, and others, is the "invisibility" of all intellectual resources. In addition to accounting-recognized intangible assets that include part of intellectual resources, there is a significant part of intellectual resources that, due to the problem of accounting recognition and measurement, cannot be expressed as part of the company's capital but only as of the cost of the period. For this reason, according to Hassaneen [11], IC reporting becomes a promising tool for resource-intensive organizations, managing, communicating, and providing crucial information for investment decision-making and helping to productively use increasingly important intangible resources such as human capital, research, and development, software, and relationships with consumers. This paper aims to show the impact that the company's intellectual resources have on the creation of added value of the company and the growth of the company's market value as one of the financial indicators that expresses the existence of that value in the company. The subject of the research will be the investment of companies in intellectual resources, which we will monitor through R&D costs

that companies record on an annual basis and see what impact this has on the company's market capitalization.

IV STATISTICAL ANALYSIS OF THE IMPACT OF RESEARCH AND DEVELOPMENT COSTS ON THE MARKET VALUE OF COMPANIES

For the purposes of the analysis, the statistical program IBM SPSS 22 was used. The research aims to determine whether there is a correlation between companies' investments in R&D and the growth of the shares market price. Subsequently, a simple linear regression was performed to determine how much the market value of companies changes if the investment in R&D changes by 1%. The analysis was conducted in the five-year period from 2016-2020, and the companies that represented the sample were Alphabet, Apple, Microsoft, Pfizer, Amazon, Johnson & Johnson, Roche.

The interdependence of the variables was examined based on correlation analysis using the Pearson coefficient.

The statistical model and the conducted analysis are based on the previously set hypotheses of the model on the interdependence of two variables [9]:

• H0 - There is a statistically significant correlation between R&D expenditures and market capitalization as indicators of a company's market performance

• H1 - There is no statistically significant correlation between R&D expenditures and market capitalization as indicators of a company's market performance

The coefficient of simple linear correlation, as a relative measure, takes values from -1 to +1. If it takes positive values, the correlation between the phenomena is direct or positive (both phenomena show DC variations). When r <0, the relationship is inverse or negative (when one phenomenon increases, the other decreases, and vice versa). If there is a functional connection between the observed phenomena (all empirical points are exactly on the straight line), we are talking about a perfect (perfect) correlation. Then the correlation coefficient takes the value -1 (if the connection is inverse) or +1 (if the connection is direct). The closer the absolute correlation coefficient is to the unit, the stronger the correlation between the phenomena. In contrast, the closer to zero, the weaker the linear relationship. The following tables (Tables 1-2) analyze the degree of correlation between R&D expenditures and market capitalization of companies.

Tabela 1- Normality of data distribution

	Tests of Normality					
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MarketCapmil$	,174	35	,009	,840	35	,000
RDExpendituremil$	,194	35	,002	,821	35	,000

a. Lilliefors Significance Correction

Source: Results of Authors' Research

If the number of observations in the sample is greater than 30, then each empirical distribution, according to the central limit theorem, tends to be normal, so each empirical distribution, for n> 30, can be approximated by normal [12].

Tabela 2- Correlation Analysis

Correlations

		MarketCapmil$	RDExpendituremil$
Pearson Correlation	MarketCapmil$	1,000	,609
	RDExpendituremil$	,609	1,000
Sig. (1-tailed)	MarketCapmil$	.	,000
	RDExpendituremil$	,000	.
N	MarketCapmil$	35	35
	RDExpendituremil$	35	35

Tabela 3 – Descriptive Statistics

Descriptive Statistics

	Mean	Std. Deviation	N
MarketCapmil$	656834,8571	490417,47132	35
RDExpendituremil$	15878,2286	8053,09584	35

Source: Results of Authors' Research

Table 2 clearly shows that there is a statistically significant relationship between the variables. Sig = 0.00, which means that the null hypothesis (Ho) is adopted. Pearson's correlation coefficient is 0.609, which means that there is a significant correlation between R&D investment and the growth of the stock market price.

The level of changes in the market price of shares in relation to the 1% change in investment in R&D was determined using simple linear regression.

Tabela 4 – Prosta linearna regresija

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,609^a	,371	,351	394942,93586	,371	19,425	1	33	,000	1,009

a. Predictors: (Constant), RDExpendituremil$

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	68235,877	149302,931		,457	,651		
	RDExpenditremil$	37,070	8,411	,609	4,407	,000	1,000	1,000

a. Dependent Variable: MarketCapmil$

Source: Results of Authors' Research

The coefficient of determination is 0.371, which means that 37.10% of the variations of the dependent variable (market capitalization) are explained by the influence of the independent variable (R&D expenditures), while the influence of other variables causes the remaining 62.90% of the variations. It should be noted that there were appropriate limitations regarding this research regarding the unavailability of certain data to make the analysis more complete. VIF <10, which means that there is no problem with multicollinearity. There is also no problem of autocorrelation DW = 1.009 because Field [13] considers that the value of DW statistics below 1 and above 3 is worrying, i.e., if the value of DW statistics is below 1 or above 3 there is a problem of autocorrelation.

Regression model would be: **MarketCapmil$= 68235,877+37,070* RDExpendituremil$**

Conclusion

The analysis shows a strong correlation between investment in R&D as one of the components for building IC and the growth of the market value of companies. However, investments in other forms of IC that are not taken into account in the work also contribute to the growth of the market value of companies as well as many other factors (economic, political, social, and other). What is evident is that in the era of the knowledge economy, intellectual resources take precedence over labor, means of labor, land, and capital due to the increasingly sophisticated desires and needs of consumers. With the development of information and communication technology and the fall in transport costs, people easily gain new knowledge and create demand in the market of products and services, and the world becomes a single economic system. The business philosophy according to which companies should constantly listen to the market and meet the diverse needs of consumers is the ultimatum of survival in modern business conditions. Innovating existing products (incremental innovations) and creating entirely new products (radical innovations) creates added value that is the key to creating and maintaining a competitive advantage in the market. In order for the innovation processes in the company to run smoothly, it is necessary to invest significantly in all components of intellectual capital (human, structural and relational capital), which will result in superior financial and business performance..

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